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7. The apparatus of claim 6 wherein said measuring means comprises a runner including a contact surface for contacting said wire.

8. The apparatus of claim 7 wherein said contact surface has a substantially straight profile.

9. The apparatus of claim 7 wherein said measuring means comprises a dolly roll for assuring that said runner and said wire remain in contact.

10. The apparatus of claim 7 including a rotation meter coupled to said runner.

REMARKS

The above-noted cancellation of claims 1-5, and substitution of new claims 6-10, as well as the substitution of a revised Abstract and Specification, are respectfully submitted prior to initiation of the prosecution of this application in the U.S. Patent and Trademark Office.

The above-noted amendments to the claims are respectfully submitted in order to more clearly and appropriately claim the subject matter which applicant considers to constitute his inventive contribution. No new matter is included in these amendments. In addition, a revised Abstract and Specification are submitted in order to clarify and correct the Specification and to conform it to all of the requirements of U.S. practice. No new matter is included in these amendments, and a copy of the marked-up Specification is respectfully submitted herewith in order to confirm same.

In view of the above, it is respectfully requested that these amendments now be entered, and that prosecution on the merits of this application now be initiated. If, however, for any reason the Examiner does not believe such action can be taken, it is respectfully requested that he telephone applicant's attorney at (908) 654-5000 in order to overcome any objections which he may have.



BINDING MEANS

FIELD OF THE INVENTION

The present invention relates to apparatus for binding wire around objects, for example bales of fiber material.

BACKGROUND OF THE INVENTION

Pulp bales are bound around both individual and stacked units comprising a certain number of bales, usually six or eight such bales. Such a unit load has a weight of between one and two tons. The strength of the wire binding together the unit load, therefore, is very important from a safety point of view, because several persons may be standing near the load while it is being lifted by its wires. The equipment used for typing the knot in a bound wire loop and the knot itself, therefore, are subject to very comprehensive safety regulations and stringent safety controls.

The binding means generally comprises a unit for feeding the wire from a wire magazine through an openable wire guide bar around the object.

The feeding unit is also used for stretching the wire. The means used for this purpose comprises a twining member, which includes a unit for locking the wire end, a unit for typing a wire knot, a cutting unit, and a unit for projecting the knot.

The wire guide bar extends around the object to be bound and guides the wire while it is fed. The wire is fed through the twining member around the object to be bound. When the free end of the wire returns to the twining member, the wire is stopped and retained in the locking unit, whereafter the wire is stretched by reversing the feeding unit. The wire guide bar is thereby opened, and the wire is tightened around the object to be bound. The knot is tied, the wire is cut and projected out of the twining member.

In order to achieve optimum binding and knot-typing results, the correct length of wire must be fed. The wire is normally fed by means of a feeding wheel, which rotates through a predetermined number of revolutions and is driven, for example, by an electric servomotor. The feeding wheel is also used for stretching the wire.

In the wire magazine, on the path of the wire from the wire magazine to the feeding wheel, and in the wire guide bar, however, the wire can jam, whereby sliding can be caused between the feeding wheel and wire. Problems can also arise because of variations in the wire quality, and in its thickness and hardness, which also result in sliding between the feeding wheel and wire.

This sliding creates problems during the feeding process. The positions of the wire cannot thus be determined, which may cause breakdowns. When, for avoiding sliding, the contact pressure from the counter-pressure rolls is increased, there is the risk of wire deformation whereby the feed of the wire through the different units in the binding means is made difficult.

SUMMARY OF THE INVENTION

In accordance with the present invention these and other difficulties have now been overcome by the invention of apparatus for binding wire around an object comprising a feed member for feeding the wire, the feed member including a feed wheel for feeding and stretching the wire, and separate measuring means for continuously measuring the length of the wire fed by the feeding member whereby the measuring means does not feed the wire. Preferably, the measuring means comprises a runner including a contact surface for contacting the wire.

In accordance with one embodiment of the apparatus of the present invention, the contact surface has a substantially straight profile.

In accordance with another embodiment of the apparatus of the present invention, the measuring means comprises a dolly roll for assuring that the runner and the wire remain in contact.

5 In accordance with another embodiment of the present invention, apparatus includes a rotation meter coupled to the runner.

The present invention thus offers a solution to the aforesaid problems, in that measuring of the length of the fed
10 wire takes place in a separate measuring means, which is not affected by sliding in the feeding wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more fully appreciated with reference to the following detailed description, which, in
15 turn, refers to the drawings in which:

Fig. 1 is a side, elevational view of a binding machine in accordance with the present invention; and

Fig. 2 is an enlarged front, perspective view of the measuring means of the present invention.

20 DETAILED DESCRIPTION

The binding means used in the binding machine of Fig. 1 is of the type shown and described in Swedish Patent No. 380,496, and in Swedish Patent Application No. 93/03380-1.

The binding means thus comprises a stand 1 on which
25 the various units are arranged. A feeding unit 2 is provided to feed binding wire 3 in the form of steel wire from a wire magazine around an object 4 to be bound, and thereafter to stretch the wire.

A measuring means 5 is provided for continuously
30 measuring the length of fed wire. The measuring is carried out without the measuring means 5 feeding the wire.

The measuring means 5 preferably comprises a runner 6, which abuts the wire 3, and preferably a compressed-air

loaded dolly roll 15 to ensure that the wire 3 and runner 6 are in contact with each other.

The runner 6 has a contact surface 16, preferably with a substantially straight profile. The measuring result is thereby less dependent on the wire quality and varying contact pressure.

The runner 6 is coupled to a rotation meter 7, for example an inductive transmitter or a potentiometer, but preferably a pulse transmitter, which measures how much the runner 6 has rolled out and, thereby, how much wire has passed the measuring means 5.

A wire guide bar 8 extends about the object to be bound 4. A twining member 9 comprises a guide bar for guiding the wire through the twining member, a unit for locking the wire end, a unit for tying a wire knot, a unit for cutting the wire, and a unit for projecting the completely tied knot.

The entire binding means is preferably movable so that it can be placed in a transport path for the objects to be bound and easily exchanged on demand.

The feeding unit 2 comprises guide wheels 10, about which the wire 3 runs, and a driven feeding wheel 11, to which counter-pressure rolls 12 abut. The feeding wheel 11 is preferably driven by an electric servomotor 13.

At the start of the binding machine the end of the wire 3 is positioned with the help of the values from the measuring means 5 to a predetermined starting position for a binding sequence.

During feeding of the wire, the feeding unit 2 is driven by the electric servomotor 13, so that a predetermined length of wire 3 is fed about the object to be bound 4, and the wire end arrives at the locking unit in the twining member 9. The fed wire length is measured by the measuring means 5. The wire end is retained in the twining member 9.

The wire stretching takes place thereafter by reversing the servomotor 13 of the feeding unit 2 until the wire has been stretched down onto the object to be bound 4, and the speed of the wire is zero. The wire movement is measured, for example, by a pulse transmitter in the servomotor 13, but preferably by the measuring means 5.

The wire guide bar 8 is openable and provided with grooves for the wire 3. During feeding of the wire, the bar 8 is held in closed position by piston/cylinder units 14, which are preferably pneumatic. During the wire stretching, the wire guide bar 8 is opened by the piston/cylinder units 14.

After the wire stretching, the units of the twining member 9 for twining, cutting and projecting the completed wire knot start to operate.

After the cutting, the wire is drawn back a predetermined length to the starting position for the next binding sequence by the feeding unit 2, which is controlled by values from the measuring means 5. The binding means is now ready for a new binding operation.

The correct length of fed wire is ensured in that the wire 3 free of sliding drives the runner 6 of the measuring unit which, by means of the rotation meter 7, transfers the measuring values for controlling the wire feed. Since the moment of inertia in the runner 6 is small in relation to the transferred moment between the wire 3 and runner 6, no sliding occurs between the wire 3 and runner 6. The accuracy and operational safety of the binding means can in this way be increased. If in spite thereof sliding should occur, this would only mean that a little too much wire is fed, which does not negatively affect the operational safety.

Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is

therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

5



ABSTRACT OF THE DISCLOSURE

Apparatus is disclosed for binding wire about bales including a feeder for feeding the wire, the feeder including a feed wheel for feeding and stretching the wire, and a separate
5 measuring device for continuously measuring the length of the wire fed by the feeder whereby the measuring device does not feed the wire.

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Binding means

FIELD OF THE INVENTION

(This) ^{the present} invention relates to ^{means} for binding wire around objects, for example bales of fiber material.

BACKGROUND OF THE INVENTION

Pulp bales are bound around both individually and ^{just} in the form of stacked units comprising a certain number of bales, usually six or eight ^{just} bales. Such a unit load has a weight of between one and two tons. The strength of the wire binding ^{tying} together the unit load, therefore, is very important from a safety point of view, because several persons may ^{be standing} ~~stand~~ near the load while it is being lifted by its wires. The equipment used for tying the knot in a bound wire loop and the knot itself, therefore, are subject ^{to} ~~of~~ very comprehensive safety regulations and stringent safety controls.

The binding means ^{generally} comprises a unit for feeding the wire from a wire magazine through an openable wire guide bar around the object.

The feeding unit ^{also} ~~is used~~ for stretching the wire. The means ^{used for this purpose} ~~comprises~~ ^{further} a twining member, which includes a unit for locking the wire end, a unit for tying a wire knot, a cutting unit and a unit for projecting the knot.

The wire guide bar extends around the object to be bound and guides the wire ^{where it is fed} ~~at its feed~~. The wire is fed through the twining member around the object to be bound. When the free end of the wire ^{returns} ~~arrives~~ for the second time ^{at the} ~~the~~ twining member, the wire is stopped and retained in the locking unit, whereafter the wire is stretched by reversing the feeding unit. The wire guide bar is thereby opened, and the wire is tightened around the object to be bound. The knot is tied, the wire is cut and projected out of the twining member.

In order to achieve ^{an} optimum binding and knot-tying result ^{of} ~~the~~, the correct length of wire

must be fed. The wire ^{is} normally (is) fed by means of a feeding wheel, which rotates through a predetermined number of revolutions and is driven, for example, by an electric servomotor. The feeding wheel is ^{also} used (also) for stretching the wire.

In the wire magazine, on the path of the wire from the wire magazine to the feeding wheel, and in the wire guide bar, however, the wire can jam, whereby sliding can be caused between the feeding wheel and wire. Problems can also arise ^{because of} by variations in the wire quality, ^{and} in its thickness and hardness, which ^{also} result in sliding between the feeding wheel and wire.

^{The} (The) sliding creates problems during the feeding. ^{press} The positions of the wire ^{then} cannot ^{the} be determined, which may cause breakdowns. When ^{then} for avoiding sliding the contact pressure from the counter-pressure rolls is increased, there is ^{also} risk of wire deformation whereby the feed of the wire through the different units in the binding means is made difficult.

→ [INSERT A] ← attached

The present invention ^{has} offers a solution ^{if} (of) the aforesaid problems, in that ^{length} (the) measuring of the fed wire (length) takes place in a separate measuring means, which is not affected by sliding in the feeding wheel.

[The characterizing features of the invention are apparent from the attached claims.]

→ [INSERT B] ← attached

[The invention is described in greater details in the following, with reference to the accompanying drawings illustrating an embodiment thereof.]

[Fig. 1 shows a binding machine.

Fig. 2 shows the measuring means.]

The binding means ^{used in the feeding machine of Fig 1} is of the type shown and described in ^{described in} the patent ^{no.} SE 380,496, and in ^{the} ~~the~~ ^{Swedish} patent application, SE 9303380-1.

The binding means ^{the} comprises a stand 1 on which the various units are arranged. A feeding unit 2 is provided to feed binding wire 3 in the form of steel wire from a wire magazine around an object 4 to be bound, and thereafter to stretch the wire.

A measuring means 5 is provided for continuously measuring the ^{length of} fed wire ^{length}. The measuring is carried out without the measuring means 5 feeding the wire.

The measuring means 5 preferably comprises a runner 6, which abuts the wire 3, and ^a preferably ^a compressed-air loaded dolly roll 15 to ensure that the wire 3 and runner 6 are in contact with each other.

The runner 6 has a contact surface 16, preferably with ^a substantially straight profile. The measuring result is thereby less ^{dependent} ~~depending~~ on the wire quality and varying contact pressure.

The runner 6 is coupled to a rotation meter 7, for example an inductive transmitter or a potentiometer, but preferably a pulse transmitter, which measures how much the runner 6 has rolled and, thereby, how much wire has passed the measuring means 5.

A wire guide bar 8 extends about the object to be bound 4. A twining member 9 comprises a guide bar for guiding the wire through the twining member, a unit for locking the wire end, a unit for tying a wire knot, a unit for cutting the wire, and a unit for projecting the completely tied knot.

The entire binding means ^{is} preferably ^{is} movable so that it can be placed in a transport path for the objects to be bound and ^{upon demand} easily ^(be) exchanged ^{independently}.

The feeding unit 2 comprises guide wheels 10, about which the wire 3 runs, and a driven feeding wheel 11, to which counter-pressure rolls 12 abut. The feeding wheel 11 ^{is} preferably ~~is~~ driven by an electric servomotor 13.

At the start of the binding machine the end of the wire 3 is positioned with the help of the values from the measuring means 5 to a pre-determined starting position for a binding sequence.

^{During feeding of}
[At] the wire ^{feed}, the feeding unit 2 is driven by the electric servomotor 13, so that a pre-determined length of wire 3 is fed about the object to be bound 4, and the wire end arrives at the locking unit in the twining member 9. The fed wire length is measured by the measuring means 5. The wire end is retained in the twining member 9.

The wire stretching takes place thereafter by reversing the servomotor 13 of the feeding unit 2 until the wire has been stretched down onto the object to be bound 4, and the speed of the wire is zero. The wire movement is measured, for example, by a pulse transmitter in the servomotor 13, but preferably by the measuring means 5.

The wire guide bar 8 is openable and provided with grooves for the wire 3. During ^{feeding of} the wire ^{stroke} ~~feed~~, the bar 8 is held in closed position by piston/cylinder units 14, ^{stroke} preferably pneumatic ~~ones~~. ^{During} [At] the wire stretching, the wire guide bar 8 is opened by the piston/cylinder units 14.

After the wire stretching, the units of the twining member 9 for twining, cutting and projecting the completed wire knot start to operate.

After the cutting, the wire is drawn back a predetermined length to the starting position for the next binding sequence by the feeding unit 2, which is controlled by values from the measuring means 5. The binding means is now ready for a new binding operation.

The correct length of fed wire is ensured in that the wire 3 free of sliding drives the runner 6 of the measuring unit which ^{General} via the rotation meter 7 transfers the measuring values for controlling the wire feed. Since the moment of inertia in the runner 6 is small in relation to the transferred moment between the wire 3 and runner 6, no sliding occurs between the wire 3 and runner 6. The accuracy and operational safety of the binding means can in this way be increased. If in spite thereof sliding should occur, this would only mean that a little too much wire is fed, which does not negatively affect the operational safety.

[The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the claims with reference to the descriptive part and drawing.]

→ (Insert C) ← deleted

INSERT A
SUMMARY OF THE INVENTION

In accordance with the present invention these and other difficulties have now been overcome by the invention of apparatus for binding wire around an object
5 comprising a feed member for feeding the wire, the feed member including a feed wheel for feeding and stretching the wire, and separate measuring means for continuously measuring the length of the wire fed by the feeding member whereby the measuring means does not feed the
10 wire. Preferably, the measuring means comprises a runner including a contact surface for contacting the wire.

In accordance with one embodiment of the apparatus of the present invention, the contact surface has a substantially straight profile.

15 In accordance with another embodiment of the apparatus of the present invention, the measuring means comprises a dolly roll for assuring that the runner and the wire remain in contact.

In accordance with another embodiment of the present invention, apparatus includes a rotation meter
20 coupled to the runner.

INSERT B

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more fully appreciated with reference to the following detailed description, which, in turn, refers to the drawings in
5 which:

Fig. 1 is a side, elevational view of a binding machine in accordance with the present invention; and

Fig. 2 is an enlarged front, perspective view of the measuring means of the present invention.

10 DETAILED DESCRIPTION

INSERT C

Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.